A HOPPERDOZER FOR ROUGH GROUND.

By Albert P. Morse, Wellesley, Mass.

During the last few years a large part of New England has been subjected to a series of extremely dry summer seasons. This climatic condition is favorable to the development of locusts or "grasshoppers" in itself, and at the same time diminishes the ravages of fungous diseases which tend to hold them in check, and stunts the vegetation on which they feed. As a natural consequence several species have multiplied to such an injurious extent, at least locally in parts of Vermont, New Hampshire, and Maine, that it is wise to consider means of artificial control.

Of the various methods of fighting grasshoppers which become locally injurious, two are of especial importance:— viz., 1st, plowing of the breeding-grounds before they hatch (or immediately thereafter), thereby burying and destroying them; and 2nd, destruction of the young before they have done much injury or are able to travel far.

Where the breeding-grounds are not now known, or an extended watch cannot be kept at hatching-time and immediate action taken, the first method cannot be considered available for the coming season. Or again, the breeding-grounds may be of such a character that plowing of them is impracticable, either by reason of their stoniness, steepness, location, or the injury which would result from washing by rains.

The second method of control — destruction of the young — may be effected under some circumstances by poisoning the vegetation in and near the hatching grounds, with arsenicals, or by the use of poisoned baits such as bran-mash or dried horse-droppings, both of which are attractive to the young 'hoppers. The use of arsenicals in pastures, however, is impracticable, and it is probable that by far the larger part of the New England breeding-grounds are used for that purpose. Another very effective method of destroying the young is by the use of "hopperdozers," long, flat, shallow pans containing kerosene or kerosene and water, which are drawn by horses over the infested fields and into which the young locusts leap and are destroyed. These, however, can be used effectively only on relatively level ground and have the disadvantage of imparting to the forage a flavor decidedly repugnant to stock. A hopperdozer to be of use in New England

should be free from this defect and should be of such construction as to allow it to be used on very uneven ground.

Freedom from repugnant odor can be secured by substituting for the coal-oil pan a piece of sheet-iron or other flat surface smeared with a suitable adhesive substance of which we have at hand an excellent one in what is known as "Tree Tanglefoot," largely used to prevent caterpillars of the gypsy-moth and canker-worms from ascending trees. A young grasshopper falling upon a surface coated with this preparation is there to stay.

The second need — adaptability to an uneven surface — may be secured by constructing the machine in sections, say two-and-a-half

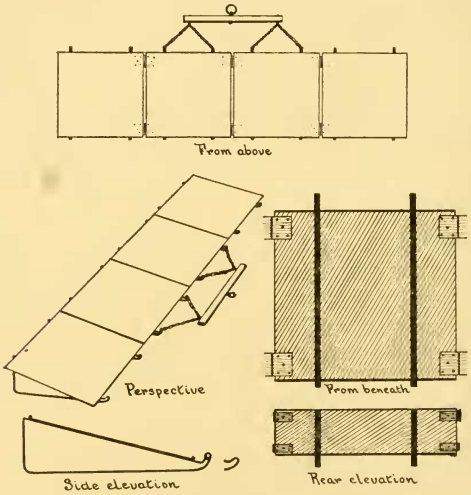

Fig. 1. For destroying grass-insects on rough ground where the use of kerosene is objectionable and the ordinary form of machine cannot be used. Designed by A. P. Morse.

or three feet long, hinged so as to be freely movable on each other, thus allowing a much closer approximation to the surface of uneven ground than is possible with a rigid pan or plate ten or twelve feet in length. The following sketches illustrate such a device, made of No. 24 galvanized sheet iron in four sections, with iron or steel runners,

so constructed as to allow considerable movement in a vertical plane, and even a folding-over of the end-sections on the middle ones for convenience in transportation. Such a machine can be readily made by a handy blacksmith, or a substitute therefor may be built of boards by any farmer, the principle remaining the same. The front and rear edges of the iron plates should be stiffened with iron rods, and the front edge should be about two inches from the ground. The runners should be of such form as to pass over minor obstructions on the ground and to permit movement backwards, for convenience.

Such a machine, properly coated with "Tree Tanglefoot" and drawn by a horse over pasture and mowing-lands during the early stages of development of the 'hoppers would capture them in large quantities, and in addition destroy myriads of leaf-hoppers (Jassidae), spittle-insects (Cercopidae), plant-bugs (Capsidae), and other grass- and grain-inhabiting insects.

A Monographic Revision of the Twisted Winged Insects Comprising the Order Strepsiptera Kirby. By W. Dwight Pierce, Bull. U. S. Nat. Mus., No. 66, pp. 232, pls. 15; figs. 4. (Dec. 1909.)

This extensive contribution represents the first attempt made to gather together and correlate the considerable amount of scattered information at present available concerning this most aberrant and interesting group of insects, and in addition it contains a large amount of new matter, relating principally to the North American members of the order.

The Strepsiptera are regarded as an order, a view which will probably receive the endorsement of other workers, although there are some such striking similarities between them and Rhipiphorid Coleoptera that it is difficult to regard them with Pierce as more closely related to the Hymenoptera and Diptera. One point upon which much stress is laid, the presence of the group in Baltic amber of Tertiary age, cannot carry conviction, for we know that in other specialized orders many amber species are almost indistinguishable from living ones.

Following his preliminary classification of the Strepsiptera published in 1908[1] the author divides the order into four superfamilies

[1] A Preliminary Review of the Classification of the Order Strepsiptera, Proc. Ent. Soc. Washington, Vol. IX, pp. 75–85.